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**PRESENTATION 4.2.2**

**TECHNOLOGY TRANSFER METHODOLOGY**

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**JOHNSON SPACE CENTER**

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**SPACE TRANSPORTATION PROPULSION TECHNOLOGY SYMPOSIUM**

**JUNE 25 - 29, 1990**

**DEVELOPMENT, MANUFACTURING, AND CERTIFICATION PANEL**

**TOPIC: TECHNOLOGY TRANSFER METHODOLOGY**

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# TECHNOLOGY TRANSFER METHODOLOGY

## AGENDA

- |                |           |
|----------------|-----------|
| 0 INTRODUCTION | BILL BOYD |
| 0 BACKGROUND   |           |
| 0 TOPIC FOCUS  |           |
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- 0 TECHNOLOGIST'S VIEW RICH LABOTZ
    - 0 FINDING A HOME FOR TECHNOLOGY
    - 0 OBSERVATIONS AND RECOMMENDATIONS
  - 0 SYSTEM DEVELOPER'S VIEW BILL BOYD
    - 0 PROVIDING A HOME FOR TECHNOLOGY
    - 0 OBSERVATIONS AND RECOMMENDATIONS
  - 0 DISCUSSION ALL

## INTRODUCTION

- 0 BACKGROUND
  - 0 DESIRABLE FEATURES OF FUTURE PROPULSION SYSTEMS
    - 0 SAFE
    - 0 HIGH PERFORMING
    - 0 LIGHT WEIGHT
    - 0 SIMPLE IN DESIGN
    - 0 RELIABLE
    - 0 LOW IN COST
    - 0 OPERATIONALLY FLEXIBLE & EFFICIENT
  - 0 ALL STRONGLY DRIVEN BY AVAILABILITY OF USEFUL TECHNOLOGIES
  - 0 AVAILABILITY DRIVEN BY "EFFICIENT TECHNOLOGY TRANSFER" FROM THE TECHNOLOGISTS TO THE SYSTEM DEVELOPERS - THE USERS
  - 0 HISTORICAL DATA:
    - 0 "NEW" TECHNOLOGIES SELDOM UTILIZED IN NEW SYSTEM DEVELOPMENTS
- 0 FOCUS OF THIS TOPIC:
  - 0 UNDERLYING ISSUES AND BARRIERS
  - 0 POSSIBLE APPROACHES TO IMPROVE TECHNOLOGY TRANSFER

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## TECHNOLOGY TRANSFER METHODOLOGY

### "PROVIDING A HOME FOR TECHNOLOGY"

- 0 ISSUES FOR NEW SYSTEM DEVELOPMENT
- 0 THE DEVELOPERS PERSPECTIVE
- 0 ONE VIEW OF THE TECHNOLOGY UTILIZATION PROCESS
- 0 BARRIERS TO PROVIDING A HOME FOR TECHNOLOGY
- 0 INCENTIVES TO USE NEW TECHNOLOGY
- 0 EXAMPLE OF TECHNOLOGY TRANSFER THAT MAY WORK
- 0 RECOMMENDATIONS

## ISSUES FOR NEW SYSTEM DEVELOPMENT

- O TECHNOLOGY IMPLEMENTATION IS INDEED NEED DRIVEN
- O DEVELOPMENT MUST RESULT IN A "ROBUST" SYSTEM
  - O RELIABLE
  - O LONG-LIFE
  - O LOW COST
  - O PERFORMANCE MARGIN
- O APPLIED TECHNOLOGY MUST BE MADE AVAILABLE
  - O RESOLUTION OF PROBLEMS AS THEY ARISE IN OPERATION

## THE DEVELOPERS PERSPECTIVE

- O INHERENT DIFFERENCE IN ENGINEERING APPROACH BETWEEN TECHNOLOGISTS AND DEVELOPERS
  - O TECHNOLOGISTS CONCENTRATE ON PERFORMANCE
  - O DEVELOPERS WANT RELIABILITY AND LIFE
- O TECHNOLOGY PROGRAMS OFTEN DEAD-ENDED
- O TECHNOLOGY OFTEN DOES NOT ADDRESS THE REAL NEEDS
- O NEW SYSTEM DEVELOPMENT PROGRAMS MUST AIM AT LOW RISK
- O SYSTEM DEVELOPMENT CANNOT AFFORD THE BURDEN OF TECHNOLOGY VALIDATION
- O INNOVATION CANNOT BE FORCED - MUST DO WHAT'S RIGHT

## BARRIERS TO PROVIDING A HOME FOR TECHNOLOGY

- O PERCEIVED HIGH RISK
  - O LEVEL OF TECHNOLOGY MATURITY
- O NOT INVENTED HERE
  - O DESIRE FOR "HANDS ON"
  - O WOULD RATHER IT HAD BEEN DONE "OUR WAY"
- O "OFF-THE-SHELF"-IT IS
  - O ECONOMICS
  - O TECHNICAL ADEQUACY OF IN-PLACE CAPABILITIES
  - O SHORT LEAD TIME
- O DEVELOPMENT MANAGERS TYPICALLY NOT TRAINED TO BE VISIONARY

## INCENTIVES TO USE NEW TECHNOLOGY

- O POSITIVE INCENTIVES
  - O TECHNOLOGY VALIDATED
  - O TECHNOLOGY UNDERSTOOD
  - O CONFIDENCE IN THE TECHNOLOGIST
  - O TECHNICAL SUPERIORITY
  - O FEELING OF OWNERSHIP
- O OTHER INCENTIVES
  - O TECHNOLOGISTS FEEL THREAT
  - O IMPOSED "FROM ABOVE"

## TECHNOLOGY TRANSFER EXAMPLE

- O ADVANCED THRUSTER CHAMBER MATERIALS
  - O IRIIDIUM/RHENIUM CHAMBER TECHNOLOGY DEVELOPED BY LERC
  - O JSC INITIATING VALIDATION OF APPLICATION TO SHUTTLE RCS VERNIER
- O VALIDATION PROGRAM OBJECTIVE - MAKE THE VERNIER MORE ROBUST
  - O IMPROVE DURABILITY, AND THUS LIFE, OF THE VERNIER
  - O SAVE VERNIER REFURB COSTS AND ORBITER TURNAROUND TIME
- O ASPECTS OF THIS TRANSFER
  - O INITIAL TECHNOLOGY OBJECTIVE TO MAXIMIZE PERFORMANCE
  - O GOAL TO ACHIEVE DURABILITY IDENTIFIED LATE IN PROGRAM
  - O PERCEIVED NEED TO JUSTIFY TECHNOLOGY EXPENDITURES
  - O VALIDATION TO BE DONE BY DEVELOPERS - GOOD
  - O VALIDATORS COMING IN "GREEN" - NOT SO GOOD

## RECOMMENDATIONS

- O ESTABLISH CO-OWNERSHIP OF TECHNOLOGY PROGRAMS
  - O MINIMIZES NIH SYNDROME
  - O FORCES DIALOGUE BETWEEN TECHNOLOGISTS AND DEVELOPERS
- O RE-FOCUS THE EMPHASIS AS APPROPRIATE FROM PERFORMANCE TO RELIABILITY AND ROBUSTNESS
- O CHANGE THE SCOPE OF TECHNOLOGY PROGRAMS
  - O REQUIRE VALIDATION OF TECHNOLOGY AS PART OF THE TECHNOLOGY PROGRAM - DON'T PLACE BURDEN ON SYSTEM DEVELOPERS
  - O ELIMINATE "PAPER" TECHNOLOGY DEVELOPMENT
  - O MAY REQUIRE REDUCING NUMBER OF TECHNOLOGY PROGRAMS
- O START PROCESS WITH PROPOSED NEW FY92 RTOPS

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INFLUENCE OF PREDEVELOPMENT ACTIVITY  
ON ACTUAL-TO-PROPOSED COST RATIO  
(DDT&E FIRST UNIT COSTS, AS OF 1983)

PROGRAM	SUBSYSTEM	PROPOSED COST(\$M)	ACTUAL COST(\$M)	COST RATIO	PREDEVELOPMENT ACTIVITY
APOLLO	SPS ENGINE	19.1	85	4.5	NONE
	CM RCS ENG	4.9	22.6	4.6	LIMITED
	SM RCS ENG	8.8	29.4	3.3	LIMITED
	CRYO STORAGE	5.5	16	2.9	SOME
	FUEL CELL	20	50	2.5	SOME
SHUTTLE	RCS PRIMARY	8.9	51.4	5.8	LIMITED
	RCS VERNIER	2.5	11.1	4.4	LIMITED
	APU	10.5	42	4.0	LIMITED
	CRYO STORAGE	6.5	14.9	2.3	EXTENSIVE
	FUEL CELL	9.8	19.5	2.0	EXTENSIVE
	OMS ENGINE	19.8	42	2.1	EXTENSIVE
	OMS POD	75	130	1.7	EXTENSIVE